SOUTHWEST MICHIGAN
SOLAR PROJECT

FREQUENTLY ASKED QUESTIONS ON

BATTERY ENERGY STORAGE SYSTEMS

General Q&A

Why are batteries needed?

As the U.S. energy landscape evolves to more renewable energy sources such as wind and solar generation and less conventional fossil fuel generation, energy storage will play an essential role to stabilize the grid. The electric grid works by matching supply and demand at every moment for the grid to function reliably. Energy storage systems store excess energy in times of low demand to be used later when it is needed, especially during peak demand hours and in times of emergency or grid outages. Storage helps to place energy on the grid when it is needed, instead of only when it is being produced when the wind is blowing or the sun is shining.

Why is energy storage important?

Energy storage fundamentally improves the way we generate, deliver, and consume electricity. Energy storage helps during emergencies like power outages from storms, equipment failures, accidents or even terrorist attacks. But the game-changing nature of energy storage is its ability to balance power supply and demand instantaneously – within milliseconds – which makes power networks more resilient, efficient, and cleaner than ever before. *(ESA, 2019)*

How is energy storage useful of a grid-scale?

Energy storage is needed on a grid-scale for three main reasons:

1. When charged with renewable energy like solar, energy storage delivers firm, flexible, clean energy and capacity.
2. Energy storage can store energy in times of excess production and discharge that energy when it is needed.
3. Energy storage provides real-time balance of power supply-and-demand, creating more reliable, stable, and productive power grids for our country.

How does an energy storage system work?

In the most basic explanation, an energy storage system charges by taking AC power from the grid or co-located generation facility and converting it to DC power to store in batteries. The system will automatically stop charging once the battery is at full charge. When there is an energy need on the grid, the system discharges energy back to the grid by converting the energy from DC back into AC.

Is energy storage technology safe?

Yes. Energy storage has been a part of our electricity grid since the 1930s and has a safety record that is similar or better than other electricity generation, distribution, or management methods. Energy storage facilities have multiple layers of automatic protection systems and are typically enclosed by fencing, which prevents children and the general public from coming into contact with the installations, thus preventing unsafe conditions.

Is energy storage clean?

Yes. Energy storage has no direct emissions. It requires no pipelines. Its systems typically require a minimal footprint. It recycles electricity. Energy storage will also help cut emissions as it takes more of the load off traditional fossil-fuel based generation. *(ESA, 2019)*

Why here?

We site energy storage facilities to maximize benefits to the grid and to rate payers. Stand-alone storage facilities are typically closer to electrical load and/or connected to the bulk transmission system (transmission lines/substations) in order to service energy users efficiently. Co-locating solar and batteries at the same site helps to smooth the power supplied by the intermittent solar output and enables the two systems to share some hardware components, which can lower costs rather than having them at different sites. Co-location can also reduce costs related to site preparation, land acquisition, labor for installation, permitting, interconnection, and developer overhead.

Technical Q&A

How do these batteries compare to the batteries in my phone or computer?

All batteries accept, store, and release electricity on demand. Batteries use chemistry, in the form of chemical potential, to store energy.

The batteries used for grid-scale applications are very similar to the lithium-ion batteries in your phone or laptop computer, except they are much larger. Grid-scale battery systems utilize this proven technology that we take for granted in our everyday lives. Just like your phone, grid batteries are rechargeable, though the heavy-duty design of grid-scale batteries allows them to be charged and discharged daily for decades.

Does electricity go straight from the panels to the batteries?

It is possible to design a system where electricity flows directly this way (DC Coupled); however, typically, the locations of solar and storage often involve placing power conversion equipment between the solar and batteries (AC Coupled).

The energy produced by the solar panels can flow directly to the batteries if the electrical grid does not have the demand to use the energy being produced, thus storing the energy for a later time.

Are they sustainable?

Yes. Energy storage batteries have a useful life of approximately 20 years and will require repowering later in the project lifecycle. The original batteries will be removed and recycled for continued use in other applications.

How efficient is battery storage?

Battery efficiency is a key metric used to select batteries for a project – the batteries we use have a “round trip efficiency” of 90-95% or greater (5-10% losses when charging and discharging the batteries). There are some additional losses when charging and discharging the battery due to other system.

Are battery systems cost-effective?

Yes. Battery energy storage costs continue to decline as the production and supply chains increase efficiencies. Energy storage is at an attractive cost to utilities and other energy users, as evidenced by large increases in grid-scale energy storage installations over the last several years. Energy storage system costs are forecast to continue to fall, with increasing demand, which will lead to an increasing number of installations throughout the U.S.

Will batteries be added to a solar system at start of construction? Or later?

Battery storage can be installed (a) at the time a solar energy facility goes into operation or (b) at a later time to an existing solar system.

How does energy or battery storage work with solar?

The solar panels absorb the energy created by the sun, creating direct current electricity. The energy battery charges in times of excess energy production and discharges when energy is needed. Energy storage helps to balance the grid, creating a more reliable and stable transmission and distribution system. Clean, reliable energy is delivered to commercial, industrial, and residential customers.

What maintenance do batteries need? How often?

Annual maintenance is conducted that involves visual inspections, various system checks and tests, and cleaning and adjustment as required.

Is it a separate interconnection? What is the process?

Batteries that are stand-alone go through their own interconnection process in the same manner as a solar facility. Batteries that are connected to solar may still have a separate interconnection process depending on the system design and regional transmission requirements.

What are the different types of battery storage installation layouts?

Energy storage installations will either utilize outdoor containers or dedicated-use buildings. For the outdoor container design, batteries will be installed in climate- controlled outdoor containers, with multiple containers daisy-chained to central inverters. An alternate higher density system will utilize a dedicated-use climate-controlled building(s) that will house multiple aisles of batteries in an open-rack configuration connected to inverters outside of the building. There are advantages to both systems depending on local codes and site considerations, but the bulk of the systems to date have been pre-engineered containerized systems.

How are they protected from outside elements? Rain, hail, snow, tornadoes.

Outdoor enclosures are designed with outdoor ratings such as NEMA 3R / IP66 to prevent water ingress. These systems are also designed with appropriate anchor bolts and latching to comply with various wind ratings per the local building code, based upon ASCE 7. This is the same code other commercial and industrial facilities are designed to.

What type of batteries will be used?

Generally, all projects will use lithium-ion batteries, with cells similar to those found in cell phones, electric vehicles, and computers.

What is the most used battery for utilities?

The most commonly used battery for utilities is lithium-ion batteries. These are also the most common batteries in electric vehicles, laptops, and cell phones.

How much electricity to they produce?

They produce the same power (MW) as equivalent solar facilities. The energy (MWh) produced is based upon the power and duration: energy = power x time. The nameplate energy rating will generally be based upon a 1 to 4-hour duration depending on the projected use case. For example, a 50 MW x 4-hour system can deliver 200 MWh in a single charge.

Is the power stored as AC or DC?

The energy is stored as DC energy and must be converted to AC to be sent to the grid.

What size will the system be? Footprint of the facility?

A good rule of thumb is 10-20MW / acre for a containerized four-hour duration system, though specific site conditions are needed to evaluate the layout fully. Battery building systems will be denser but may have other setback and siting requirements.

Will I see lower electricity bills?

Likely not in the short-term, but energy storage can lead to cost savings in two primary ways:
1) By lowering the overall cost of providing electricity
2) By allowing customers to avoid premium pricing or “peak demand”
In addition, energy storage deployment can save consumers money through shorter outages. Fewer power outages after a storm or fewer equipment failures can help save not only money but lives as well. Overall, fewer outages lead to fewer economic losses. *(ESA, 2019)*

What type of enclosure will be used?

This varies by manufacturer. Typically, they are housed in an enclosure similar to a 40’ ISO shipping container or smaller. Some are smaller module-type units that measure 5 ft x 5ft x 7 ft.

Fire & Safety Q&A

What about thermal runway and fires? What is the likelihood of a battery fire?

Lithium-ion cells rarely experience failure leading to fire, however modern codes and standards such as NFPA-855 and UL-9540a require several independent preventative features to be included to minimize the risk of fire. With all these features in place and fully operational, the likelihood of a fire is reduced even further. These features include a battery management system, remote monitoring, gas detection, ventilation, and in some installations, fire suppression.

How does the battery's control system help prevent fires?

All energy storage systems come equipped with a battery management system (BMS) that continuously monitors sensors for temperature, voltage, and current at the battery module level. If the sensors determine a failure is at risk of occurring, the BMS will automatically shut down the battery and alarm until the issue is resolved. The sensor groups also issue a failsafe 'heartbeat' signal, ensuring the system will shut down if communication to the sensors is lost.

How will offsite personnel know if an incident has occured onsite?

Remote monitoring will occur over the lifetime of the battery, ensuring that personnel are remotely notified of problems via alarms as soon as they occur.

If a fire does take place, what measures are taken to help minimize the extent of fires?

I. In most instances of a fire in a containerized battery system, fire water will be applied to the exterior of the container by the fire department to reduce the heat of the container and minimize the possibility of fire spread. Full details of approach will be included in the emergency response plan and fire safety plan.

II. In addition, battery installations incorporate some form of flammable gas detection / elimination / ventilation equipment. These sensors act to detect, eliminate, and/or ventilate flammable gases from the container atmosphere.

III. In instances where self-contained outdoor enclosures are utilized, the enclosures are tested per UL-9540a and equipped with relief mechanisms as required. Additionally, fire suppression can be employed to further reduce damage to internal components.

IV. Fire suppression equipment, including water-based suppression, is required for all battery installations that can be entered by personnel (such as buildings). If required, these systems will be designed to meet all applicable local and national codes.

How will our local fire department be prepared or trained to handle a fire situation at a battery storage system?

An emergency response plan will be developed which will provide detailed response procedures. This plan will be reviewed by the local Fire Marshall and fire department, and training will be conducted to familiarize the local responders with this plan.

What does a developer do to work with the local fire protection personnel to prepare for a new energy storage system?

In addition to the measures mentioned above, emergency signage, emergency operations plans and training are provided in conjunction with local fire services to ensure the hazards are communicated and planned for. An emergency response plan will be developed which will provide detailed response procedures. This plan will be reviewed by the local Fire Marshall and fire department, and training will be conducted to familiarize the local responders with this plan.

What are the steps in a typical fire safety plan for a battery storage system?

A fire safety plan is an extensive document that will be approved by the Fire Marshall and will include site equipment and hazard overview and map, list emergency contacts, document the proper reporting and response procedures, describe the location and descriptions of alarm indication, signage, and emergency switches, describe the fire protection and firefighting equipment, and list required personal protective equipment (PPE) and safety data sheets.

In the event of a fire, what is contained in the water used to extinguish the fire? Is foam used or some special extinguisher fluid?

Water used for fire suppression/cooling to address battery fires is normal fire water piped from city/town sources, hydrants, or other typical fire water sources such as well water or water on fire trucks. No special foam or liquid is required.

While also not required, inert non-toxic “clean agent” non-water-based automatic fire suppression such as FM-200 or NOVEC 1230 may be used in select locations within the building/containers/racking on some systems as additional countermeasures to limit internal damage.

In the event of a fire, what is contained in the water used to extinguish the fire? Is foam used or some special extinguisher fluid?

The primary purpose of water being used on an outdoor battery container is to reduce the heat of the container. A vast majority of the water sprayed onto the container will only contact the container housing and will not contact the battery modules themselves. The small amount of water that does leak into the container will be removed as part of the cleanup and decommissioning process.

In the event of a deluge event inside a dedicated-use battery building, the water will be treated in the same manner as deluge water used in other types of electrical fires and dealt with in a similar manner. We are not aware of any ground water contamination issues with battery fire water in these applications.

Does fire water after contact with batteries contain toxins or chemicals that can contaminate ground water?

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In the event of a fire, what is contained in the smoke? Are there chemicals or toxins released into the air?

Smoke from any fire can be hazardous to humans, and therefore people should avoid contact with smoke or take measures to reduce their exposure. We are not aware of any data that suggests battery fire smoke is any more or less toxic than residential, commercial, or industrial fires.

What kind of chemicals would be used if a fire does start? Concerns about groundwater and these chemicals?

Self-contained, outdoor enclosures are not required to have fire suppression installed as these units are designed to contain the fire through other means. While also not required, clean agent suppression such as FM-200 or NOVEC 1230 are additional countermeasures to limit internal damage that are nonwater-based solutions that may be deployed.

To date, we are not aware of any ground water contamination issues associated with energy storage systems. Ground water contamination has not been an issue in the market with energy storage facilities. Similar to other equipment used in the electrical systems, the units are designed to hold any potential liquids through multiple layers of containment.

Will there be a bond for potential fire cleanup?

No, not usually required.

Do batteries leak?

Lithium-ion cells do not leak electrolytes during normal operation like some 'flooded' lead-acid batteries used in substations and UPS equipment. Lithium-ion battery modules will only leak if they experience catastrophic failure. Most of the leakage will be in the form of gasses, and the volume of liquid electrolyte will be trace amounts of volume compared to that found in the more common flooded lead-acid batteries. These gases and liquids are contained within the energy storage container with safety measures incorporated to deescalate the situation.

Does an energy storage system create noise?

The energy storage equipment will be designed to be consistent with local noise requirements. The noise emitted is no higher than most electrical transformers or HVAC condensers.

Once the construction phase of the energy storage system is complete and the facility is operational, the primary source of noise will be fans associated with the inverter and battery cooling systems and will be similar to the sound emitted from commercial rooftop HVAC units.

Environmental & Impacts Q&A

What can I expect to see during construction?

The process for constructing an energy storage facility is relatively simple. The construction process may require some heavy machinery or trucks. Typically, there are a few deliveries per day but not enough to provide a large increase in traffic. Workers arrive and leave at the beginning and end of each workday and work occurs during typical business hours.

What is planned to ensure there are no environmental or visual impacts of an energy storage system?

During the development phase we will look to minimize the impact on the surrounding community by:

· Evaluating adjacent land uses (current and future) to evaluating the compatibility of an energy storage project

· Minimizing environmental disturbance to the existing site through best management practices with respect to natural resources and storm water and sediment control. Environmental surveys will be conducted for all energy storage projects, and the projects will be coordinated with the appropriate environmental regulatory agencies.

· Developing a comprehensive understanding of local zoning codes to design in accordance with existing requirements and pursue variances when only necessary

· Utilizing setbacks from property lines and public rights-of-way and strategic landscaping to provide a landscape buffer that reduces and/or eliminates visual impacts of battery storage units from adjacent land uses

· Utilizing natural and native vegetation in the landscaping to preserve the rural character of the area

How far from houses will it be? Setback/buffer?

This depends on permitting requirements and can be reviewed on a per-project basis subject to land constraints.

Do energy storage systems have negative impacts on neighboring property value?

When proper setbacks and vegetative screening are used accordingly, energy storage facilities are excellent neighbors as they do not create sound, traffic, or visual obstruction.

What are the appropriate standards when land with historical or archaeological significance is developed for energy storage facilities?

Some communities have local preservation ordinances or established local historic districts that require local approval for new construction visible from a public way. Developers will work with local planning, historical or historic districts commissions regarding any required local approvals.

What positive impacts will an energy storage facility have on the local community?

Energy storage facilities provide positive impacts to the local economy through increased tax revenues to local governments, the creation of new jobs (during the construction phase), and landowner royalties. At the same time, energy storage facilities DO NOT strain public infrastructure, schools, or emergency services, making energy storage facilities a true “silent revenue generator” that benefits the entire community over several decades.

Why do energy storage systems make good neighbors?

Energy storage projects produce no emissions, waste, or byproducts.

Grid energy storage systems do not generate electricity.

The siting of a typical system consists of multiple enclosures, each with multiple battery racks and electrical equipment to safely change/discharge electricity to and from the grid.

Systems are safe to humans, property, and the environment; operate quietly and are easily placed in urban, suburban, and rural settings.

Energy storage projects may also be a good use of unused industrial zoned properties.

Decommissioning Q&A

How long do batteries last?

Batteries can last twenty years or more depending on their usage. They will undergo some degree of degradation over their lifetime, where they will experience reduced capacity—similar to how a cell phone battery loses charge capacity over time.

What happens to them at the end of life?

At the end of life, batteries are removed from the system and recycled in accordance with applicable requirements.

Will there be a decommissioning plan?

Many permitting requirements include a decommissioning plan as well as a decommissioning bond.